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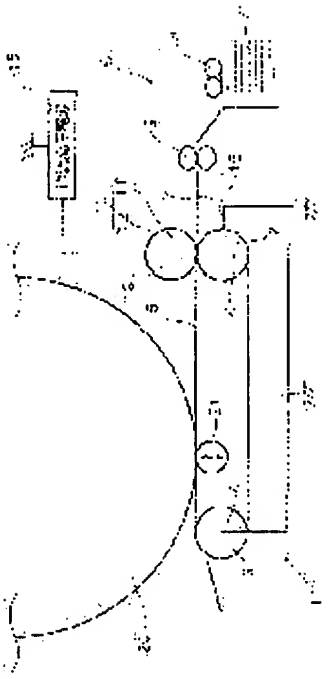
(54) PAPER CARRYING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an electrostatic attraction system paper carrying device preventing ozone generation problems and assuring attraction effect.

SOLUTION: An electrostatic attraction belt 5 is applied around a conductive roll 2 of a grounded paper feeding side and a conductive roll 3 of a paper delivery side. An electrifying roll 10 connected to a direct current high voltage power supply 15 is brought into pressure connect with the conductive roll 2 of the paper feeding side through the electrostatic attraction belt 5. An antistatic brush 16 is deployed before an electrifying brush with respect to the rotational direction of the electrostatic attraction belt and near the electrostatic attraction belt abutting the conductive roll 2 of the paper feeding side. A paper sheet 7 after passing over the electrifying roll is carried with being electrostatically attracted by the belt. This eliminates the use of a corona static eliminator, suppressing ozone generation problems, and reducing manufacturing costs. Irregular electrification generated on the belt after the paper sheet is stripped can be surely eliminated, allowing assured attraction effect to improve carrying reliability. Changing the voltage applied to the electrifying roll according to the paper



type and environmental conditions can adjust the attraction force to an optimum level.

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention makes the belt which circulates and rotates carry out electrostatic adsorption of the form, and relates to the form transport device which conveys the form concerned in the predetermined direction by rotation of the belt concerned. The form transport device of this invention is applicable to various airline printers and image formation equipment.
[0002]
[Description of the Prior Art]
As a form transport device which it circulates through, and the rotating belt is made to carry out electrostatic adsorption of the form, and is conveyed, what was indicated by JP,11-105400,A and JP,11-147359,A, for example is known.
[0003]
The form transport device indicated by these reference has the electric discharger which discharges the electrostatic adsorption belt immediately after having been prepared the electrification equipment which it is prepared [equipment] near the roll by the side of the starting point of the conveyance range of the form by the electrostatic adsorption belt which was hung about on two or more rolls, and was made rotatable, and the electrostatic adsorption belt, and electrifies an electrostatic adsorption belt, and near [other] the roll by the side of this terminal point, and discharging a form. In addition, the thing of the corotron method of the non-contact method with which each of electrification equipments and electric dischargers performs corona discharge is used, and electrification equipment and an electric discharger need to use the power source which serves as reversed polarity mutually.
[0004]
[Problem(s) to be Solved by the Invention]
According to the form transport device mentioned above, the equipment of the non-contact method by corona discharge was used as electrification equipment and an electric discharger, but according to the equipment of this corona discharge method, there was a problem that air was ionized and ozone occurred with the energy of the high voltage. Although the measures against ozone were taken also in conventional equipment, in connection with the rise of consciousness to an environmental problem, a small amount of ozone is also made into a problem, and still much more low ozonization is called for strongly in office.
[0005]
Moreover, if a bearer rate becomes to some extent quick at any rate when a bearer rate is comparatively slow, a form must be made to stick to a belt by the strong suitable force in the form transport device which conveys by carrying out electrostatic adsorption of the form at a belt. In order to acquire this strong electrostatic adsorption power, it is necessary to constitute a belt from a high material of surface resistivity, and to collect many charges with a high dielectric constant. However, since a volume resistivity will also become high and a self-electric discharge function will be lost if surface resistivity is

high, there is un-arranging [that the powerful electric discharge means of the corona discharge method generally mentioned above is needed, and the problem of ozone generating mentioned above cannot be solved fundamentally].

[0006]

Furthermore, if the high voltage direct current power source of reversed polarity is mutually used for the power source of electrification equipment, and the power source of an electric discharger in order to raise electric discharge of a belt and it will become, since the DC power supply of reversed polarity are needed, this other than the DC power supply for electrification also has the problem of causing the rise of cost, and expansion of a required installation tooth space.

[0007]

Then, solving the problem of ozone generating completely in the form transport device of an electrostatic adsorption method without using a corona electric discharger, it can ensure electric discharge that the unevenness of the charge produced to a belt after form exfoliation should be canceled, and this invention aims at offering the form transport device of the positive low cost of the absorption which can respond also to high-speed conveyance of a form.

[0008]

[Means for Solving the Problem]

The conductive roll by the side of feeding held free [rotation] where the form transport device indicated by claim 1 is grounded, and the conductive roll by the side of delivery, The electrostatic adsorption belt which is hung and turned to the conductive roll by the side of said feeding, and the conductive roll by the side of said delivery, and rotates, The electrification means arranged so that a pressure welding may be carried out to the conductive roll by the side of said feeding through said electrostatic adsorption belt, It has the electric discharge means which discharges said electrostatic adsorption belt which is in a near side rather than said electrification means about the direct-current high voltage power supply connected to said electrification means, and the rotation direction of said electrostatic adsorption belt, and touches the conductive roll by the side of said feeding.

[0009]

The form transport device indicated by claim 2 is characterized by said electric discharge means being an electric discharge brush in the form transport device according to claim 1.

[0010]

The form transport device indicated by claim 3 is characterized by said electrification means being the electrification roll which prepared the conductive elastic body in the front face of a conductive core material in the form transport device according to claim 1.

[0011]

The form transport device indicated by claim 4 is characterized by said electrostatic adsorption belt being constituted by the polymeric materials which have high insulation resistance in the form transport device according to claim 1.

[0012]

The form transport device indicated by claim 5 has a conveyance condition grant means to give the conveyance conditions of a form, and the control means which sets up the applied voltage which said direct-current high voltage power supply gives to said electrification means corresponding to the conveyance conditions of the form given by said conveyance condition grant means in the form transport device according to claim 1.

[0013]

The form transport device indicated by claim 6 is equipped at least with one side of an environmental grasp sensor which grasps the environment where the selection section said whose conveyance condition grant means chooses the class of form to convey, and a form are conveyed in the form transport device according to claim 5.

[0014]

[Embodiment of the Invention]

Hereafter, the operation gestalt of this invention is explained based on a drawing. Drawing 1 is ** type

structural drawing showing some mimeograph airline printers as an image formation means to have the form transport device of this invention.

[0015]

The form transport device 1 has the conductive roll 2 by the side of feeding, and the conductive roll 3 by the side of delivery. Both the conductivity rolls 2 and 3 are metal rolls, it is mutually arranged in parallel so that both rotations may be attained, and the driving means is connected with the revolving shaft of the conductive roll 3 by the side of delivery. The electrode 4 is in contact with the revolving shaft of both the conductivity rolls 2 and 3 possible [sliding], respectively, and this electrode 4 is grounded.

[0016]

On the conductive roll 2 by the side of feeding, and the conductive roll 3 by the side of delivery, if the endless electrostatic adsorption belt 5 (belt 5) is hung about and the conductive roll 3 by the side of delivery drives by the driving means, it will circulate and rotate in the predetermined conveyance direction.

[0017]

In order that said electrostatic adsorption belt 5 may acquire the strong electrostatic adsorption power which collects many charges with a high dielectric constant, and can be equal to high-speed conveyance, it has high insulation resistance and consists of high materials of surface resistivity. The polymeric materials whose volume resistivity is the thickness of 50-150 micrometers more than 1014-ohmcm in this example, and the owner polarity plastics which has the big dipole moment also in a high dielectric like a polycarbonate and polyvinylidene fluoride are specifically desirable. In this example, 100-micrometer polyvinylidene fluoride was adopted, and it was seamless, and really fabricated, or has made for the endless belt by ultrasonic welding by it.

[0018]

There is the feed section 6 in the near side of the conductive roll 2 by the side of feeding about the conveyance direction of a form. There is a loading plate which is not illustrated and which can be gone up and down in the feed section 6, and two or more sheets of forms 7 are accumulated on this loading plate. The feed roll 8 is formed above the rise-and-fall plate, and when a rise-and-fall plate goes up in connection with the send of a form 7, the top face of the accumulated form 7 can touch the feed roll 8, and can take out the top form 7 with the feed roll 8.

[0019]

The timing roll 9 is formed between said feed rolls 8 and conductive rolls 2 by the side of feeding, and the form 7 which the feed roll 8 took out can be sent out to the electrostatic adsorption belt 5 side to required timing.

[0020]

The electrification roll 10 is formed above the conductive roll 2 by the side of said feeding rotatable as an electrification means to electrify the electrostatic adsorption belt 5 and a form 7. The electrification roll 10 is arranged in the location which presses the conductive roll 2 by the side of feeding through the electrostatic adsorption belt 5, is inserted between the electrostatic adsorption belts 5 which circulate through the form 7 sent from said timing roll 9, and rotate, and is conveyed. In that case, it applies to the conductive roll 2 from the electrification roll 10 side, and electric field are given to the electrostatic adsorption belt 5 and form 7 which were inserted into the electrification roll 10 and the conductive roll 2, by this, electrostatic polarization occurs in the electrostatic adsorption belt 5 and a form 7, and a form 7 sticks to the electrostatic adsorption belt 5.

[0021]

The electrification roll 10 twists the conductive elastic body 12 around the circumferential front face of the conductive core material 11 which is metal cylinder-like rodding. The conductive elastic body 12 consists of an electrical conducting material which made natural rubber, EPDM rubber, silicone rubber, etc. distribute an electric conduction filler, and the volume-resistivity value is 106. It is omegacm extent. EPDM rubber (a rubber degree of hardness is 40 degrees) with a thickness of 1mm which distributed electric conduction carbon fine particles was wound around the conductive core material 11, and the electrification roll 10 was constituted from this example, and where it turned this electrification roll 10

to the electrostatic adsorption belt 5 and the conductive roll 2 by the side of feeding and it is pressurized by about 40-N force, it has arranged.

[0022]

As mentioned above, since the electrification roll 10 has the conductive elastic body 12 on a front face and is pressurized towards the conductive roll 2 by predetermined thrust, the conductive elastic body 12 concerned will be crushed by the pinching part of a form 7, and a form 7 will be contacted with a fixed area. Therefore, compared with the case where the electrification roll of the rigid body which the capacity of the capacitor constituted with the electrification roll 10 and a form 7 does not transform shall carry out line contact at a form 7 etc., it becomes large, and the charge with which a form 7 is covered becomes large.

[0023]

Moreover, although it is thought that exfoliation electrification arises in case the electrostatic adsorption belt generally hung about on the conductive roll moves to a feed direction and exfoliates from this conductive roller As mentioned above in this example, a volume-resistivity value is 106 to a circumferential front face. Since the electrification roll 10 which twisted the conductive elastic body 12 which is omegacm extent is formed and the electrostatic adsorption belt 5 is made to contact In case it exfoliates from a conductive roller towards the feed direction of a form, it is thought that the effectiveness that this electrification roller 10 reduces exfoliation electrification produced to the electrostatic adsorption belt 5 is done so.

[0024]

In addition, the electrification roller 10 which carries out elastic deformation like this example as an electrification means, and sandwiches a form 7 by fixed nip width of face may be used, and also with the electrification blade with which the conductive elastic body 12 was formed in the part which contacts a form 7 at least, if fixed nip width of face is obtained at all according to deformation of the conductive elastic body 12, the same effectiveness as the electrification roller 10 and abbreviation is acquired.

[0025]

Moreover, as a conductive elastic body 12 of the electrification roll 10, not only conductive rubber but conductive sponge etc. is sufficient.

[0026]

It connects with the revolving shaft of said electrification roll 10 through the electrode 13 on which the direct-current high voltage power supply 15 can slide. The polarity of said electrification roll 10 by this direct-current high voltage power supply 15 is arbitrary, and the other end of the direct-current high voltage power supply 15 is grounded. The electrical potential difference which this direct-current high voltage power supply 15 may impress to the electrification roll 10 is adjustable, and an environmental condition. s (temperature, humidity, etc.) It is adjusted by the control means later mentioned according to the classes (thickness, surface treatment condition, etc.) of form 7 to convey etc.

[0027]

If the charge which collected in the form adsorption before it remains in case a form 7 and the electrostatic adsorption belt 5 are charged with said electrification roll 10, the inflow of the charge from the electrification roll 10 side will not be performed good, formation of electric field cannot be performed easily, and said electrostatic polarization will stop being able to occur easily. Since the charge which collected in former form adsorption is what serves as charge unevenness of the front face of a belt 5, and is produced in case the form 7 which carried out electrostatic adsorption exfoliates from the electrostatic adsorption belt 5 with conveyance, it cannot prevent this completely. So, in this example, we decided to form the electric discharge means grounded so that a closed circuit which makes the front face of a belt 5 short-circuit might be constituted as a policy which reduces the built inconvenient residual charge in the location which counters the conductive roll 2 by the side of feeding.

[0028]

In this example, as drawing 1 and this are expanded and it is shown in drawing 2 , it was a near side from said electrification roll 10 about the rotation direction of the electrostatic adsorption belt 5, and said electrostatic adsorption belt 5 in contact with the conductive roll 2 by the side of said feeding was

approached, and the electric discharge brush 16 as an electric discharge means has been arranged.
[0029]
In this example, even if it approaches the electrostatic adsorption belt 5 almost wound around the conductive roll 3 by the side of delivery and forms an electric discharge brush, the effectiveness which discharges a belt 5 becomes small relatively. This is because the belt 5 almost wound around the conductive roll 3 by the side of delivery with rotation of a belt 5 exfoliates from this roller 3, discharge arises here, an electrification phenomenon occurs in a part and the electric discharge unevenness of the front face of a belt 5 arises. Moreover, a belt 5 cannot be discharged, even if it approaches the electrostatic adsorption belt 5 between two conductive rolls, a feeding side and a delivery side, 2 and 3 and forms the electric discharge brush 16. The belt 5 in the location concerned is large in the thickness direction, electrostatic polarization has happened, and since the holding power is tough, with an electric discharge brush, effectiveness is hardly acquired.
[0030]
Drawing 3 is an equal circuit which shows electric discharge of the electrostatic adsorption belt 5 in this example. That is, since the belt 5 which counters the electric discharge brush 16 is grounded and the electric discharge brush 16 is also grounded, the charge stored in the belt 5 can flow and electric discharge of a belt 5 is performed effectively. Thus, the electric discharge brush 16 of this example can discharge a belt 5 effectively [since the specific location which is just before making it charged, and approached the belt 5 in the condition of having contacted the conductive roll 2 has been chosen and arranged / before making it charged]. Thus, since the closed circuit was efficiently constituted from this example using the electric discharge brush, it can be charged effectively and the electrostatic adsorption power over the belt 5 of a form 7 can fully be heightened.
[0031]
In drawing 1 , the printing cylinder 20 for printing for printing in a form 7 is arranged possible [a rotation drive] in the predetermined location of the electrostatic adsorption belt 5 upper part. Although not illustrated, there is an ink supply means in the interior of the printing cylinder 20 for printing, and the front face is looped around the engraved mimeograph stencil paper. Moreover, the electrostatic adsorption belt 5 is inserted and the press roll 21 is formed in said printing cylinder 20 for printing and opposite side free [rise and fall]. The form 7 conveyed with the electrostatic adsorption belt 5 is pushed against the front face of said printing cylinder 20 for printing with the press roll 21 which goes up according to the conveyance timing, and printing is performed.
[0032]
Next, the form transport device 1 of this example is an environmental condition about the electrical potential difference which the direct-current high voltage power supply 15 gives to the electrification roll 10. s (temperature, humidity, etc.) It adjusts according to the classes (thickness, surface treatment condition, etc.) of form 7 to convey etc., and has the means for generating required electrostatic adsorption power. First, the reason for preparing the adjustment device of this electrical potential difference is explained.
[0033]
At this form transport device 1, it applies to the conductive roll 2 from the electrification roll 10 side, electric field are given, and the adsorption to the belt 5 of a form 7 occurs by making the electrostatic adsorption belt 5 and a form 7 produce electrostatic polarization by this. As an index which shows the ease of being charged, it is a volume resistivity. (insulation) The electrification phenomenon in which a higher thing (generally polymerization form macromolecule) is bigger is shown. However, the amount of charges stored (the amount of static electricity) It is greatly influenced of an environment, especially relative humidity. If air dries and relative humidity becomes low, it will take to it, objective moisture will evaporate in air, and desiccation of a body will progress. Static electricity tends to occur and, also in a natural material like cotton or a tree, static electricity occurs [especially relative humidity] at 35% or less, so that relative humidity is low.
[0034]
On the other hand, if relative humidity exceeds 65%, generally stopping occurring can understand static

electricity with feelings through everyday life. For a material with hygroscopicity like paper, a volume resistivity also changes a lot because water content changes. Since the water molecule has the big dipole moment, if water is carried out, it will have big effect on dielectric characteristics (dielectric loss increases).

[0035]

Although the polymeric materials without a hydrophilic group do not almost have hygroscopicity, the surface electrical resistance decreases as humidity becomes high. When a water molecule adheres to a film front face, a charge tends to escape by standing in a row like the film, and the amount of electrifications is made to decrease as a result.

[0036]

it explained above -- as -- an environmental condition -- moreover, also according to printing conditions, such as a class, a bearer rate, conveyance number of sheets, etc. of a form 7, since the amount of electrifications is influenced greatly, it is necessary to generate the electrostatic adsorption power of the optimal form certainly according to the purpose of form conveyance for this reason -- the form transport device 1 of concrete fixed structure -- said environmental condition etc. -- ** -- by it being alike, determining suitable applied voltage experimentally, and making the memory of equipment memorize by making this into a condition table, optimal adsorption power can be realized and conveyance and separation of a form can be performed.

[0037]

Drawing 4 is the block diagram showing the configuration for adjusting the direct current voltage applied to the electrification roll 10 for the purpose which was mentioned above in form 7 transport device 1 of this example. The environmental grasp sensor 22 (sensor for detecting the environmental condition of a humidity sensor, a thermo sensor, etc.) as a conveyance condition grant means to detect the environmental condition as conveyance conditions for a form 7 is connected to CPU23 as a control means. Moreover, the panel 24 for actuation which can specify the class of form 7 as conveyance conditions for a form 7 is connected to said CPU23.

[0038]

Said sensor 22 could be formed in another object with the body of equipment so that it may measure the environmental conditions (humidity etc.) of the location in which it is prepared in one part of this form 7 transport devices 1, or the form transport device 1 is installed. In addition, the electrical potential difference given to the electrification roll 10 becomes large as humidity becomes high.

[0039]

Said panel 24 has two or more form class assignment keys 25, 26, 27, and 28 for setting up the class of form 7 to convey, as shown in the enlarged drawing of drawing 5 . In this example, four, pasteboard (it is displayed on a panel 24 as "thickness"), a regular paper (it is displayed on a panel 24 as "**"), thin paper (it is displayed on a panel 24 as "**"), and coat paper (it is displayed on a panel 24 as a "coat"), were set up as a class of form 7.

[0040]

Since surface treatment is generally carried out among the classes of four kinds of papers shown here, the coat paper (form class assignment key 28) to which a current tends to flow cannot be charged most easily, and needs to enlarge most the electrical potential difference given to the electrification roll 10. Hereafter, applied voltage serves as pasteboard, a regular paper, and thin paper at descending.

[0041]

moreover, as shown in drawing 5 , the panel 24 has the ten key 29 and numeric display 30 which were prepared in a setup other than the form class assignment keys 25-28, such as printing number of sheets, the print-speed setting keys 31 and 32 (the panel top -- respectively -- "size", "smallness", and the display) and the bar display 33 for a rate display which increase or decrease a print speed, and the start key 34 of printing initiation.

[0042]

Since the form transport device 1 of this example is used for the mimeograph airline printer, it is adjustable and two or more steps are set up, and the print speed enlarges the electrical potential

difference given to the electrification roll 10 as a bearer rate becomes large. In addition, since the bearer rate of a print sheet is generally fixed when using the form transport device 1 of this example for form conveyance of an electronic reproducing unit and the image formation equipment of an ink jet method, adjustment of the electrical potential difference according to change of a bearer rate is not performed.
[0043]
the environmental condition mentioned above in RAM35 -- ** -- the data about the suitable applied voltage which was alike and was determined experimentally are stored as a condition table.
[0044]
The program for CPU23 to control by reading required corresponding data from RAM35 based on the data inputted from the sensor 22 grade is stored in ROM36.
[0045]
Said direct-current high voltage power supply 15 is connected to CPU23. CPU23 reads the data corresponding to the data inputted from said sensor 22 and panel 24 from ROM36, said direct-current high voltage power supply 15 can be controlled by this, and the electrostatic adsorption belt 5 and a form 7 can be made to produce electrostatic polarization in the optimal condition corresponding to conditions.
[0046]
In conveying a form 7 using the form transport device 1 which becomes the above configuration, the class of form 7 is first specified by the form class assignment keys 25-28 of a panel 24, printing number of sheets is specified with a ten key 29, a bearer rate is set up by the print-speed setting keys 31 and 32, and printing is started by the start key 34.
[0047]
According to the printing terms and conditions inputted as the humidity and temperature which were detected by the sensor 22 from said panel 24, CPU23 determines the optimal applied voltage, and controls the direct-current high voltage power supply 15, and the optimal applied voltage corresponding to conditions is applied to the electrification roll 10 by this. On the other hand, a driving means drives and the electrostatic adsorption belt 5 begins rotation at uniform velocity. And after the belt conditions after number rotation become fixed, supply of a form 7 is performed from the feed section 6. Since electrostatic polarization arises in the condition of having been suitable for conveyance conditions, to a form 7 and the electrostatic adsorption belt 5, the form 7 conveyed is held by the suitable electrostatic adsorption power for a belt 5, and is conveyed certainly.
[0048]
If the form 7 of the set-up number of sheets is conveyed, CPU23 will cut the electrical potential difference which the direct-current high voltage power supply 15 has given to the electrification roll 10, and will also stop rotation of a belt 5.
[0049]
Although prepared in the mimeograph airline printer, in other airline printers and image formation equipment, it can also be used as a conveyance means of a print sheet, and the form transport devices 1 explained above are sheet objects, such as sheet paper. (sheet-like object) In a processor, it can also use as a conveyance means.
[0050]
[Effect of the Invention]
Since according to this invention the electrostatic adsorption belt which is a near side from an electrification means about the rotation direction of an electrostatic adsorption belt, and touches the conductive roll by the side of feeding was approached and the electrification means connected to the direct-current high voltage power supply has been arranged in the form transport device which hung the electrostatic adsorption belt about on the conductive roll of a pair at least as explained above, the following effectiveness can be acquired.
[0051]
1) It is not necessary to use a corona electric discharger, the problem of ozone generating is solved completely, and a manufacturing cost can also be reduced.

[0052]
2) Since this can be certainly discharged even if the unevenness of a charge arises to a belt after form exfoliation, an absorption is trustworthy and the dependability of conveyance improves.
[0053]
3) Since adsorption power can be adjusted corresponding to conveyance conditions, such as an environmental condition and printing conditions, irrespective of environmental conditions, such as humidity, also corresponding to the class and bearer rate of a form, it is certain and reliable conveyance can be realized.
[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram showing the example of 1 structure of the gestalt of operation of this invention.
[Drawing 2] It is a perspective view near [in the example of 1 structure of the gestalt of operation of this invention] an electric discharge brush.
[Drawing 3] It is a representative circuit schematic explaining the electric discharge operation in the example of 1 structure of the gestalt of operation of this invention.
[Drawing 4] It is a control-block Fig. in the example of 1 structure of the gestalt of operation of this invention.
[Drawing 5] It is drawing showing the panel for actuation in the example of 1 structure of the gestalt of operation of this invention.
[Description of Notations]
1 -- A form transport device, 2 -- The conductive roll by the side of feeding, 3 -- Conductive roll by the side of delivery,
5 -- An electrostatic adsorption belt, 10 -- Electrification roll as an electrification means,
11 -- A conductive core material, 12 -- A conductive elastic body, 15 -- Direct-current high voltage power supply,
16 -- Electric discharge brush as an electric discharge means,
22 -- Environmental grasp sensor as a conveyance condition grant means,
23 -- CPU as a control means,
25, 26, 27, 28 -- Form class assignment key as a conveyance condition grant means,
29 -- Ten key as a conveyance condition grant means,
30 -- Print-speed setting key as a conveyance condition grant means.

[Translation done.]